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What is Claimed:

- 1 1. A method for treatment or remediation of soil or groundwater
2 contaminated with unwanted pollutants comprising the steps of:
 - 3 a) preparing generally spherical zero valent iron particles having a
4 diameter no larger than about ten millimeters and a porosity greater than 0.1; and
 - 5 b) placing said particles in said soil or a path of groundwater flow;
6 whereby said particles effect reduction of said pollutants.
- 1 2. A method according to claim 1
2 including the step of introducing said zero valent iron particles into an
3 underground aquifer via a test well positioned between a source of pollution and a well
4 used to draw a potable water from said aquifer.
- 1 3. A method according to claim 1
2 including the step of using said zero valent iron particles to form a
3 permeable portion of a barrier placed in an aquifer downstream of pollutant plume in
4 said aquifer.
- 1 4. A method according to claim 1 including
2 the step of preparing said zero valent iron particles by:
 - 3 a) preparing a generally spherical substrate of a material that can be
4 converted to volatile matter or a gas at elevated temperature;
 - 5 b) coating said substrate with metallic iron to form a substantially
6 continuous layer at least 0.25 nm thick;
 - 7 c) exposing said coated substrate to one of a chemical reagent or a
8 temperature high enough to remove said substrate to form a hollow iron particle; and
 - 9 d) reducing iron oxides in said particle to metallic iron.
- 1 5. A method according to claim 4
2 including forming said zero valent iron particles with an outside diameter
3 less than 10 nm.
- 1 6. A method for preparing porous iron particles having a size up to
2 10 millimeters comprises the steps of:

3 a) preparing a generally spherical substrate of a material that can be
4 converted to volatile matter or a gas at elevated temperature;

5 b) coating said substrate with metallic iron to form a substantially
6 continuous layer at least 0.25 nm thick;

7 c) exposing said coated substrate to one of a chemical reagent or a
8 temperature high enough to remove said substrate to form a hollow iron particle; and

9 d) reducing iron oxides in said particle to metallic iron.

1 7. A method according to claim 6

2 including the step of forming said substrate with a diameter no larger
3 than about 10 millimeters.

1 8. A method according to claim 6

2 including the step of fabricating said substrate from an organic polymer
3 selected from polymers readily fabricated into generally spherical particles less than 10
4 millimeters in diameter that will accept deposition of an iron coating at least 0.25 nm
5 thick and are readily removable from the iron by thermal or chemical treatment.

1 9. A method according to claim 6 including selecting a temperature
2 for step (c) no lower than 500°C.

1 10. A method according to claim 8 including the step of selecting said
2 organic polymer readily converted to volatile or gaseous matter at temperatures of
3 500°C or above.

1 11. A method according to claim 6

2 including the step of charging said substrate into a solution of one of
3 ferric or ferrous iron.

1 12. A method for treatment or remediation of groundwater
2 contaminated with unwanted pollutants comprising the steps of:

3 a) preparing generally spherical zero valent iron particles having a
4 diameter no larger than about ten millimeters and a porosity greater than 0.1;

5 b) charging said particles into a receptacle having an inlet and an outlet
6 defining a pathway through said particles,

7 c) introducing said pollutant groundwater into said inlet; and

8 d) recovery cleaned water from said outlet.

1 13. A method according to claim 12 including the step of preparing
2 said zero valent iron particles by:

3 a) preparing a generally spherical substrate of a material that can be
4 converted to volatile matter or a gas at elevated temperature;

5 b) coating said substrate with metallic iron to form a substantially
6 continuous layer at least 0.25 nm thick;

7 c) exposing said coated substrate to one of a chemical reagent or a
8 temperature high enough to remove said substrate to form a hollow iron particle; and

9 d) reducing iron oxides in said particle to metallic iron.

1 14. A method according to claim 12 including forming said zero valent
2 iron particles with an outside diameter less than 10 nm.

1 15. A generally spherical hollow zero valent iron particle being no
2 larger than about ten millimeters in diameter and having a porosity greater than 0.1.

1 16. A zero valent iron particle according to claim 15 wherein a second
2 metal selected from the group consisting of Pd, Pt, Ag, Co, or mixtures thereof is added
3 to the surface of said particle in amount so that said second metal is less than about
4 10% of the total weight of said particle.

1 17. A zero valent iron particle fabricated by:

2 a) preparing a generally spherical substrate of a material that can be
3 converted to volatile matter or a gas at elevated temperature;

4 b) coating said substrate with metallic iron to form a substantially
5 continuous layer at least 0.25 nm thick;

6 c) exposing said coated substrate to one of a chemical reagent or a
7 temperature high enough to remove said substrate to form a hollow iron particle; and

8 d) reducing iron oxide in said particle to metallic iron.